

# Precedence of Global Features in Virtual Environments

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**Abstract**—A result compatible with the Gestalt principles of grouping, David Navon showed that people are faster in identifying features at the global level than at the local level. This effect is known as “global precedence”. In this work we show initial results that support Navon’s findings through the proposal of a novel Navon task (consists of 20 trials) in a virtual environment and its execution by 10 participants. Specifically, relative to global feature identification, we found an increase of 455 milliseconds in correct response time and 4 times higher error ratio at local feature identification, in average.

**Index Terms**—grouping, global precedence, visual perception, Navon task, virtual

## I. INTRODUCTION

Virtual reality technologies has been booming in recent years. There is an ongoing steady virtualization process, as more of our routine (professional, social and recreational likewise) becomes virtual. It is thus interesting to test the effect of virtuality on cognitive mechanisms.

Navon showed in [1] that in identification tasks, people are likely to correctly respond faster to features and make fewer mistakes at the global level than at the local level.

One of the original Navon tasks, the one that inspired our work, is an identification of specific letters in figures - each figure showing a large letter that is composed of a group of a smaller letter.

In order to verify that the global precedence effect persists in virtual environments, we propose a novel Navon task, which consists of 10 trials repeated in 2 different virtual settings - a beach and a forest. In our proposed task, instead of small letters forming a larger letter, in each trial there is a group of animals of one type and an individual animal of another type, and the participant is required to respond to the appearance or nonappearance of specific types of animals.

## II. METHODS

Using the Unity game engine, we created two virtual settings - for each one we designed the same 10 trials. Throughout these trials we use 6 types (virtual models) of animals - bear, wolf, deer, crab, frog and snake. In each trial a group of animals of one type appear and an individual animal of another type appears among them (Fig. 1).

In each trial the participant is required to respond correctly and as quickly as possible - by pressing the right arrow key if at least one bear or crab appear, and pressing the left arrow



Fig. 1. Many bears and one snake at the beach (left) and in the forest (right).

key otherwise. Our program records the response time (in ms) and correctness of the response for each trial.

Of the 10 trials - 2 include the targets as a group, 2 include them as individuals and 6 do not include them at all.

## III. RESULTS

10 participants, 7 males and 3 females, performed our task. The youngest participant’s age is 8, and the oldest participant’s age is 70; the average age is 38, and most participants are in their 20s or 30s.

In 9 of the 10 cases, the average correct response time for group level identification trials was lower than for individual level identification trials. In one case only the error ratio in individual level identification trials was lower than in group level identification trials. The response averages over the 10 participants are shown in Tab. I.

Relative to global feature identification, we found an increase of 455 ms in correct response time ( $t \approx 2.24; p \approx 0.026$ ) and 4 times higher error ratio at local feature identification, in average.

## IV. DISCUSSION

Our results corroborate the persistence of the global precedence effect in virtual environments. However, whereas the original Navon tasks consists of 504 trials, our task consists

TABLE I  
RESPONSE AVERAGES

Correct Response Time in ms			Error Ratio		
Group level	Individual level	No target	Group level	Individual level	No target
1709	2164 (+ 455)	2445	0.05	0.20 (* 4)	0.02

of 20 trials only. It is thus necessary to extend the task with much more repetitions for a more comprehensive study.

Furthermore, our results are prone to selection bias, due to the author's acquaintance of all participants. For a more comprehensive study, a proper sampling is required to produce reliable results.

It is also interesting to test the effect of long-exposure to virtual environments on the global precedence effect by performing either classical or virtual Navon tasks after a prolonged activity in a virtual environment.

## V. CONCLUSION

In this work we proposed and created a novel Navon task in a virtual environment. The task was then executed by 10 participants, and their response averages corroborate, with statistical significance, the persistence of the global precedence effect in virtual environments.

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## REFERENCES

- [1] D. Navon, "Forest before trees: The precedence of global features in visual perception," *Cognitive Psychology*, vol. 9, no. 3, pp. 353–383, Jul. 1977.